

**REMARKS**

Claims 1, 2 and 4-23 are all the claims pending in the application, prior to the present Amendment.

The Examiner has withdrawn his previous indication that claims 1, 2 and 4 have been allowed.

The Examiner sets forth five separate rejections of the claims as unpatentable over five different references.

Applicants discuss these five rejections below.

Claims 1 and 6-8 have been rejected under 35 U.S.C. § 102(e) as anticipated by the Hu et al article.

Applicants submit that Hu et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

The present invention as set forth in claim 1 as amended above is directed to a vapor grown carbon fiber, each fiber filament of the carbon fiber having a branching degree of at least 0.15 occurrences/ $\mu\text{m}$ , and wherein the vapor grown carbon fiber has a bulk density of 0.025  $\text{g}/\text{cm}^3$  or less.

The present invention as set forth in claim 2 as amended above is directed to a vapor grown carbon fiber characterized by comprising carbon fiber filaments, each having a branching degree of at least 0.15 occurrences/ $\mu\text{m}$ , in an amount of at least 10 mass%, and wherein the vapor grown carbon fiber has a bulk density of 0.025  $\text{g}/\text{cm}^3$  or less.

Thus, applicants have amended claims 1 and 2 to incorporate the subject matter of claim 4 relating to bulk density. Applicants have canceled claim 4.

Claim 4 was not subject to this anticipation rejection. Accordingly, the amendments to claims 1 and 2 to incorporate the subject matter of claim 4 overcomes this rejection.

Further, Fig. 2 of Hu et al, which is referred to by the Examiner, is a magnification of an SEM image of a Y-shaped carbon fiber, and a branched carbon fiber is shown in the photo corresponding to an actual length of about 400 nm. However, since the length of the whole fiber is not shown, the branching degree cannot be determined from Fig. 2 of Hu et al.

The present specification states, at page 18, that the “branching degree (b/SL) is calculated from the sum of the lengths (ΣSL) of the carbon fiber filaments and the total branching points (b) of the filaments, both being measured within a field of view.” It is apparent that a fiber having a length of 7 μm or more is measured for evaluating a branching degree of 0.15 occurrences/μm (1 occurrence/7 μm  $\approx$  0.15 occurrences/μm). Accordingly, a branching degree cannot be evaluated from a photo corresponding to an actual length of about 400 nm as in Fig. 2 of Hu et al.

In addition, as disclosed at page 75, lines 15-17 of Hu et al, the product of Hu et al is “a mixture consisting of CNTs with multijunctions, amorphous carbon nanoparticles and cobalt encapsulated carbon nanoparticles.” Fig. 1 of Hu et al also shows that most of the mixture is a particulate product other than CNTs. That is, the product of Hu et al contains numerous amorphous carbon nanoparticles, which would not have a bulk density of 0.025g/cm<sup>3</sup> or less as recited in claims 1 and 2.

In view of the above, applicants submit that Hu et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

Claims 1, 2 and 5-8 have been rejected under 35 U.S.C. § 102(e) as anticipated by U.S. Patent 7,122,132 to Morita et al.

Applicants submit that Morita et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

Claim 4 was not included in this rejection. As discussed above, the subject matter of claim 4 has been incorporated into claims 1 and 2. Accordingly, the amendments to claims 1 and 2 overcome the anticipation rejection.

Further, the Examiner states that Morita et al disclose a vapor grown carbon fiber, wherein each fiber has a branching degree of at least 0.15 occurrences/ $\mu\text{m}$  in Fig. 2. However, Fig. 2 of Morita et al is a magnification image as in Hu et al, and, therefore, it is not appropriate to discuss a branching degree based on Fig. 2 of Morita et al.

In addition, the carbon fiber of Morita et al is produced by adjusting the ferrocene concentration to from 5 to 10 mass % according to the method described in Japanese Patent No. 2778434. Japanese Patent No. 2778434 is cited as a prior art document in the present specification, and is characterized in spraying a raw material solution at a spray angle of 30° to 120°. Japanese Patent No. 2778434 thus corresponds to Comparative Example 1 of the present specification.

In Comparative Example 1 of the present specification, a raw material solution containing ferrocene in 5.5 mass % and sulfur in 0.39 mass % was fed at a spray angle of 60°,

and the resultant carbon fiber had a branching degree of 0.13 occurrences/ $\mu\text{m}$ . Thus, Morita et al do not disclose a carbon fiber having a branching degree of 0.15 occurrences/ $\mu\text{m}$  or more as set forth in the present claims.

In view of the above, applicants submit that Morita et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

Claims 1, 2 and 4-8 have been rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over WO 00/58536 to Nishimura et al. The Examiner uses U.S. Patent 6,489,026 to Nishimura et al as an English translation.

Applicants submit that Nishimura et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

Nishimura et al states that “the starting material can be produced through methods disclosed in Japanese Patent Application Laid-Open (kokai) Nos. 7-150419, 5-321039, 60215816 and 61-70014 and Japanese Examined Patent Publication (kokoku) Nos. 5-36521 and 3-61768.” See column 6, lines 43-48 of Nishimura et al ‘026. That is, the production method of the carbon fiber used in Nishimura et al is a method such as in Comparative Example 1 of the present specification or a gasification method.

The Nishimura et al patent, in its examples, refers to JP 7-150419 as disclosing the method for producing the carbon fibers. JP 7-150419 discloses a spraying technique, with a spraying angle of 30 to 120°. A spraying angle of 60° was employed in its Example. As discussed above, Comparative Example 1 of the present specification employed a spraying angle of 60°, and did not achieve the branching degree of the present invention. As shown in

Comparative Example 1 of the present specification, a spray angle of 60° as in Nishimura et al would not achieve the branching degree of the present invention.

Thus, by the method in Comparative Example 1 of the present specification, carbon fiber having a branching degree of 0.15 occurrences/ $\mu\text{m}$  cannot be produced.

Further, by the gasification method, carbon fiber having a small number of branches is produced, as described at page 2, lines 11-18 of the present specification.

Accordingly, Nishimura et al do not disclose a carbon fiber having a branching degree of 0.15 occurrences/ $\mu\text{m}$  or more. Nishimura et al aim to improve the electrical conductivity by the graphitization of a carbon material.

In view of the above, applicants submit that Nishimura et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

Claims 1, 2 and 4-8 have been rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over the Endo et al article.

Applicants submit that Endo et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

The Examiner particularly refers to the disclosure at page 1295 of Fig. 14b, especially the lower right quadrant.

The Examiner states that Endo et al disclose a vapor grown carbon fiber, wherein each fiber has a branching degree of at least 0.15 occurrences/ $\mu\text{m}$  in Fig. 14b, lower right quadrant.

However, Fig. 14b is a photo of carbon fiber in a carbon electrode sheet. Since this photo is not clear, and a part of the fiber is embedded in the electrode, the branching degree cannot be determined from the photo. Though each fiber has a branch(es) as the Examiner mentioned, it does not have a branching degree of 0.15 occurrences/ $\mu\text{m}$  or more judging from the photo.

Accordingly, Endo et al do not disclose a carbon fiber having a branching degree of 0.15 occurrences/ $\mu\text{m}$  or more.

In view of the above, applicants submit that Endo et al do not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

Claims 1, 2 and 6-8 have been rejected under 35 U.S.C. § 102(b) as anticipated by the Lozano article.

Applicants submit that Lozano does not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

Claim 4 was not included in this rejection. Since the subject matter of claim 4 has been incorporated into claims 1 and 2, applicants submit that the anticipation rejection has been overcome.

Further, the Examiner especially refers to Fig. 1 a at page 34 of the Lozano article.

The Examiner states that Lozano discloses a carbon fiber, wherein each fiber has a branching degree of at least 0.15 occurrences/ $\mu\text{m}$  in Fig. 1 a. However, the total branching points (b) of the fiber in Fig. 1 a seems to be two at most. In order to have a branching degree of 0.15 occurrences/ $\mu\text{m}$  or more, the sum of the lengths (EL) must be about 14  $\mu\text{m}$  or less. However, the

sum of the length ( $\Sigma L$ ) in Fig. 1a is apparently more than 14  $\mu m$ . Therefore, Lozano does not disclose a carbon fiber having a branching degree of 0.15 occurrences/ $\mu m$  or more.

In view of the above, applicants submit that Lozano does not disclose or render obvious the subject matter of the present claims and, accordingly, request withdrawal of this rejection.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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**23373**

CUSTOMER NUMBER

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